Soil nutrients – Olsen P

This factsheet contains information on the Olsen P soil indicator used for *State of the Environment (SOE) monitoring and reporting*, for local policy-makers such as councils, land managers, and the general public.

All plants require phosphorus (P) for growth. Many New Zealand soils have naturally low levels of plant-available P, and indigenous plants are adapted to this. Phosphorus 'availability' differs between soils due to differences in soil minerals, organic matter, and chemistry, with P-retention (also called Anion Storage Capacity) being a key factor influencing the loss of soluble P to waterways.

On farms, P primarily comes from fertiliser and organic materials including livestock manure, with loss of P to waterways a major environmental concern.

Regular soil testing helps ensure that P is applied only where needed – supporting plant growth, reducing unnecessary fertiliser costs, and minimising environmental impacts.

Testing for soil phosphorus

Olsen P is the standard soil test used in New Zealand to estimate **plant-available P**. It helps determine how much P fertiliser is needed for optimal plant growth.

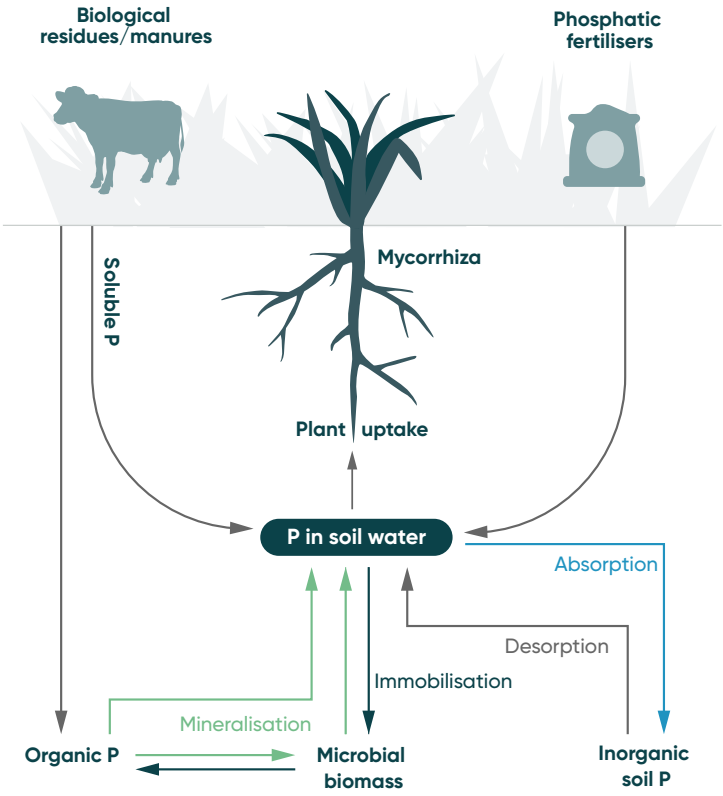
Other soil P tests may be more suitable in specific contexts. For example, the **Bray P** test is often used in **forestry**, because pine forest soils are generally acidic.

Olsen P is measured or reported as follows:

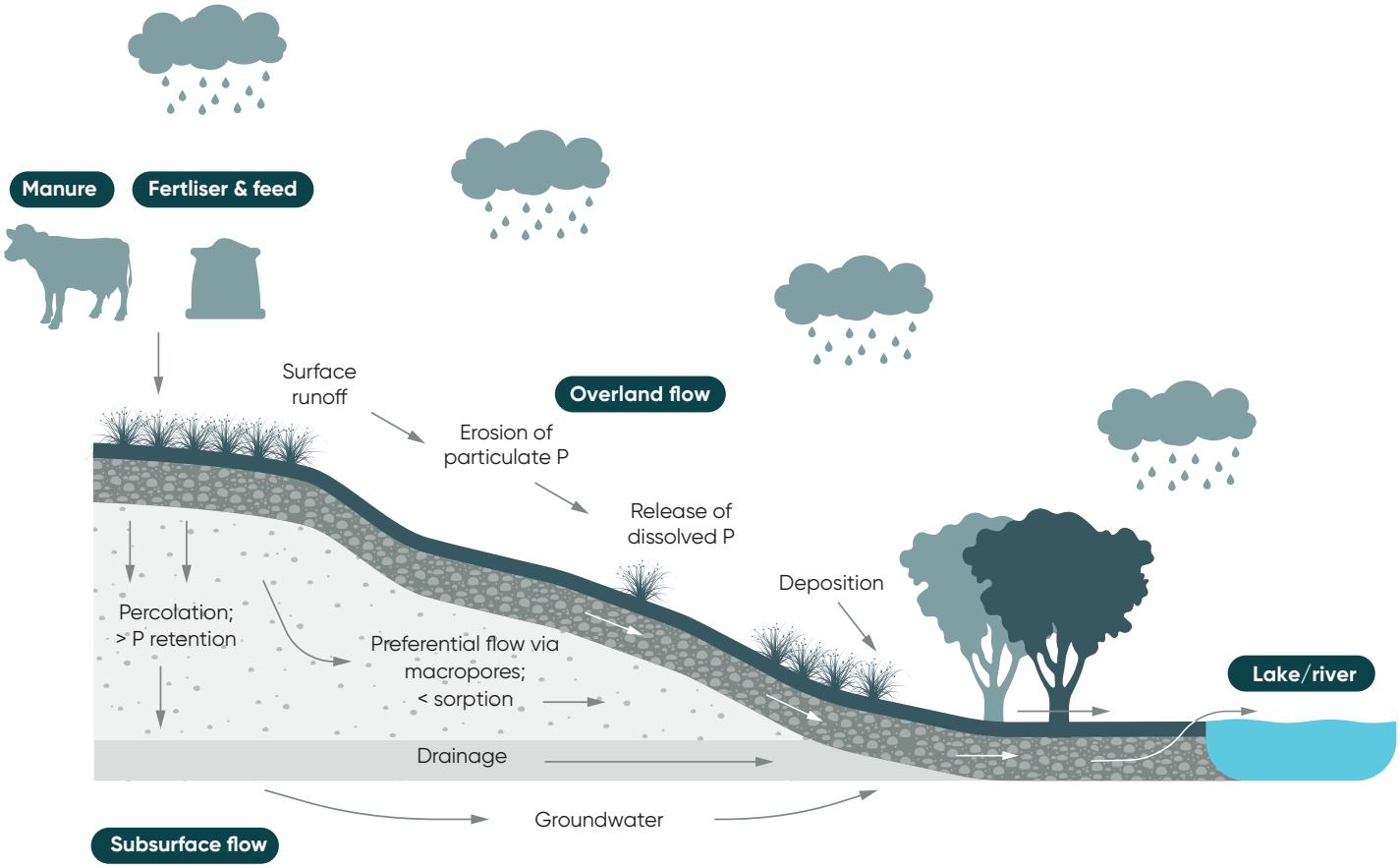
- **Gravimetric** (based on known mass of soil) – often used for SOE monitoring.
- **Volumetric** (based on the laboratory volume-weight of soil) – commonly used in fertiliser recommendations.

For State of the Environment soil quality monitoring, reference ranges for soil Olsen P are largely based on agronomic considerations and have been developed for different land-use categories and soil orders.

Applying more P than recommended offers no real productivity benefit, but increases environmental risk. The loss of P to waterways, mostly by soil erosion, depends on land management practices such as frequency of grazing, stocking rate, and timing of grazing or fertiliser application in relation to rainfall, as well as topography, and proximity to waterways. Higher Olsen P increases the risk that P will end up in waterways.



Soil phosphorus cycle.



Factors influencing the off-site movement of soil phosphorus.

Managing phosphorus levels for farmers and growers

Soil testing of the nutrient status and the chemical/physical status of soil will show farmers and growers which nutrients to apply, how much, and when. If too little is added, crops will not produce as expected. If too much is applied or is applied at the wrong time or in the wrong way, excess nutrients may run off the fields and pollute streams and groundwater.

Phosphorus requirements differ for pastures and individual crop species. The Fertiliser Association of New Zealand (FANZ) and primary sector industry bodies have recommendations for individual crop species.

Managing cadmium and other contaminants

Phosphate fertilisers are derived from phosphate rock, which contains trace levels of a range of elements. Cadmium is the primary contaminant of concern, and can be detected in varying amounts in root and leafy vegetables. Plant uptake of cadmium can be influenced by many factors.

Factsheets and guides are available for growers and farmers to help manage cadmium in their farming system.

A tiered fertiliser management system is also in place to help minimise cadmium accumulation in soil.

More information on cadmium is available from:

- Monitoing cadmium in NZ soils | NZ Government
- Managing contaminants | Fertiliser Association of New Zealand Inc.

This factsheet is part of a series produced in 2025 by the Bioeconomy Science Institute, for the Regional Council Land Monitoring Forum.